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IS COORDINATION OF FISCAL DEFICITS NECESSARY ?*

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Abstract: National budget deficits can create externalities through their effects on international interest rates. This paper examines the scope for fiscal rules restricting government borrowing for the case where government revenues (on the margin) stem from capital income taxation. There is no need to coordinate national borrowing, if governments have access to both a saving and an investment tax instrument. In the absence of a saving tax, however, national fiscal policies affect welfare abroad through the international interest rate. A reduction in first period deficits tied to increased government spending later is always welfare improving. Reducing first period deficits without further coordination of subsequent tax and spending policies will generally not improve welfare.

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1. *Introduction*

According to the Maastricht Treaty, European nations have to meet debt and deficit restrictions of at most 60 and 3 percent of GDP as preconditions for joining the European Monetary Union. The Treaty of Amsterdam of June 1997 further formalizes a stabilization pact that also restricts deficit spending after the start of the monetary union. Again, nations are restricted to have a budget deficit of no more than 3 percent of GDP. Violations of this norm in principle can result in a fine of at most 0.5 percent of GDP. International agreements that limit national deficit spending and borrowing arise from the perception that national deficit spending creates negative externalities on foreign countries. The creation of a monetary union with a European Central Bank accentuates the potential for negative externalities, as this common central bank can be called upon to 'bail out' a heavily indebted member country by providing it with cheap credit that ultimately threatens union-wide price stability. Long before European Monetary Union, however, there was a perception that national fiscal deficits create negative externalities to other nations via various transmission channels - notably higher interest rates. Widening U.S. budget deficits in the early 80's, for instance, raised interest rates worldwide, thereby raising the cost of debt finance for many governments.¹ National fiscal policies, and their effects on worldwide interest rates, continue to be regular topics of discussion at summit meetings of the G-7 group of the major industrialized countries.

Deficits by definition are the difference between revenues (mostly tax revenues) and spending. Therefore, this paper examines the underlying rationale for international rules to restrict national deficit spending in a stylized two-period model of taxation and public spending. The model abstracts from any internal redistributive or political dimensions of deficit spending (see, e.g., Alesina and Tabellini (1990)). Also, we abstract from the possibility that national deficit spending can elicit an international transfer via a bail-out or changed inflation policies of the European Central Bank (see, for instance, Buiter, Corsetti and Roubini (1993), Eichengreen and Von Hagen (1996), and Beetsma and Uhlig (1997)), or that national fiscal policy affects domestic

welfare through interest payments on the (net) international debt. Larger national deficits, all the same, affect the international interest rate, and thus saving, investment and the (internal) cost of financing public deficits in all countries. Such macroeconomic transmissions of national fiscal policies exist in the European Union as well as in the larger world economy.

Government spending in each of two periods is financed by capital income taxation in the form of a saving tax (according to the residence principle) and an investment tax (according to the source principle); the investment tax is short-hand for a more elaborate corporate income tax. In most countries, capital income taxation indeed is a mix of these two types of taxes. First period government spending in excess of revenues is debt-financed. Government paper competes in private portfolios with physical capital investments. By considering government spending in two periods financed by capital income taxes, this paper extends two strands of the literature. On the one hand, Bucovetsky and Wilson (1991) and Huizinga and Nielsen (1996), in the tradition of local public finance, consider public spending in a second period financed by simultaneous taxation. On the other hand, an extensive literature in international macroeconomics addresses the transmission of fiscal policies in the world economy. Frenkel and Razin (1986a, 1986b) notably consider how the timing of taxes affects the world interest rate and welfares in a two-country model, without considering policy coordination issues.

Bucovetsky and Wilson (1991), specifically, show that there is no need to coordinate capital income taxation, if countries have access to both investment and saving taxation.² We show that this result continues to hold after first period government spending and borrowing is introduced into the model. Thus, when both saving and investment taxes are available, there is no need to restrict governments' first period borrowing by way of budget deficit ceilings. Earlier contributions, in contrast, generally find there is a need to coordinate deficit policies, if taxes are distortionary. Chang (1990), for instance, features government expenditure financed by lump-sum or labor income taxes in an overlapping generations model. The fiscal deficit of any single government in his model affects the world interest rate, and he finds that the associated interna-

tional externalities result in inefficiently large fiscal deficits. Persson and Tabellini (1995) further present two different models used to address the need for coordination of countries' fiscal policies.³ In the first, expenditures are financed by labor income taxes, while international interest changes have international pecuniary externalities. Within this framework, they find a need for coordination to create larger public surpluses (smaller deficits). In the second framework, public goods are financed by (source-based) capital income taxes. Here the level of the capital tax and of public spending will be too low in the absence of coordination. Hamada (1986) further examines government outlays financed by contemporaneous lump-sum taxes. He finds no need for deficit coordination, unless there is generational overlap.

This paper generalizes the existing literature by having distortionary investment and saving taxes financing public expenditures in each of two periods, potentially implying first period public deficits. As mentioned, with both source- and residence-based capital income taxes available to governments, there is no need to coordinate national debt policies. In this instance, the net return to saving and the gross return to investment are optimally chosen independently of the international interest rate. A change in the international interest rate then does not affect an individual country's welfare. As the international interest rate is the only international transmission channel, there is no need to coordinate tax policy.

In practice, however, the savings tax is increasingly eroded by tax avoidance and evasion. Hence, it is interesting to consider, as Bucovetsky and Wilson (1991) do, the case where only source-based investment taxes are available. In this instance, the private economy and tax policy are not insulated from changes in the international economy. In fact, an individual country's welfare decreases with the international interest rate, as a higher interest rate discourages taxed investment. Fiscal policy coordination then improves welfare, if it brings about a reduction in the world interest rate. In a world where government spending in each of two periods is financed by a source-based capital income tax payable in the second period, several fiscal coordination schemes can be envisioned. An increase in second period spending financed by higher investment

taxes is shown to increase welfare, as it lowers the international interest rate. Larger second period government spending financed by a reduction in first period government spending similarly improves welfare. Higher first period government spending financed by higher investment taxes, in contrast, is shown to have ambiguous welfare implications. The reason is that first period government spending and the higher investment taxes have opposing effects on the international interest rate. The coordination is welfare-improving, however, if the investment demand elasticity is high relative to the marginal propensity to save in the first period.

Finally, this paper considers a coordinated reduction in first period fiscal deficits by itself, without any coordination of subsequent taxing and spending policies. The investment tax and second period government spending then continue to be set noncooperatively. In general, countries will adjust both the investment tax and second period government spending in response to the coordinated first period deficit reduction. In fact, we show that almost inevitably second period spending is increased in response to the first period deficit reduction. Switching government spending from the first to the second period, as already discussed, improves welfare. Therefore, the condition for a coordinated first period deficit reduction to be welfare improving is less stringent than if the first period deficit reduction was wholly matched by an investment tax reduction. Overall, the results of this paper confirm Buiter and Kletzer (1992, p. 650) in saying: ‘When only non-lump-sum taxes and transfers are possible, efficiency will require, in general, coordination of national budgetary policies, as well as of the tax instruments used, the rates at which they are levied and the levels of spending on internationally enjoyed public goods.’

The remainder of this paper is organized as follows. To set the stage, section 2 first analyzes tax and debt policy in a small open economy with full access to the international capital market. Section 3 then turns to the optimal income tax policy in a closed economy, where the interest rate is fully endogenous to private and public demand for and supply of funds. The tax and debt policies in the closed economy are a benchmark for the coordination of overall fiscal policies in the multi-country case. Section 4 examines the scope for tax and debt policy coordination in the

open economy by considering various combinations of coordinated fiscal policies. Section 5 considers under what conditions a constraint on budget deficits may be welfare-improving. Section 6 concludes.

2. *Tax and debt policy in the small open economy*

Let there be many symmetric small open economies that exist for two periods.⁴ Each country takes the world interest rate, r , as given. A country's representative agent receives an endowment, Y , of a single good in the first period. This endowment is allocated between first period consumption, C_1 , and saving, S . In the first period, firms make investments, K , which are productive only in the second period. In the second period, households spend their net-of-tax return from saving and their profit income to consume C_2 . Consumers also enjoy public goods, G_1 and G_2 , in periods one and two. In this two period model, G_1 and G_2 can be interpreted as spending on the young and the old. To finance these public goods, the government can impose a tax, u , on saving and a tax, v , on investment payable in the second period. In addition, the government is assumed to have a first period endowment income of X .⁵ The first period public budget deficit and thus its debt, D , are equal to $G_1 - X$.

Firms produce an output $F(K)$ in the second period, where the production function F is strictly concave. Firms' profits are equal to $F(K) - (1 + r + v)K$, where $1 + r + v$ is the user cost of capital. The maximization of profits on the part of firms yields the following familiar investment rule: $F'(K) = 1 + r + v$.

Households face the following two-period budget constraint,

$$C_2 = (Y - C_1)(1 + r - u) + F(K) - (1 + r + v)K \quad (1)$$

Households derive utility from consumption in both periods and from the public goods, G_1 and G_2 , so that lifetime utility can be written as $U(C_1, C_2) + V(G_1) + W(G_2)$. The first order

condition regarding the private consumption choice is given by $U_1 = U_2(1 + r - u)$, where U_i is the marginal utility of consumption in period i .

The government's budget constraint stipulates that overall tax revenues cover the spending on public goods in the two periods as follows,

$$G_2 = (X - G_1)(1 + r) + uS + vK \quad (2)$$

Tax policy is set so as to maximize the utility of the representative agent. Formally, the government faces the problem of choosing the tax rates u and v and public expenditures G_1 and G_2 so as to maximize the following Lagrangean expression

$$L = U(C_1, (Y - C_1)(1 + r - u) + F(K) - (1 + r + v)K) + V(G_1) + W(G_2) + \lambda(uS + vK - (G_1 - X)(1 + r) - G_2) \quad (3)$$

where λ is the Lagrange multiplier associated with the government budget constraint (2).

The optimality conditions associated with (3) regarding the tax rates u and v and public goods, G_1 and G_2 are as follows,

$$-U_2 + \lambda(1 - u e_u) = 0 \quad (4)$$

$$-U_2 + \lambda(1 + u p - e_v v) = 0 \quad (5)$$

$$V'(G_1) - \lambda(1 + r) = 0 \quad (6)$$

$$W'(G_2) - \lambda = 0 \quad (7)$$

where $e_v = - (dK/dv)/K$ is the semi-elasticity of investment with respect to the investment tax, v , and $e_u = - (dS/du)/S$ is the uncompensated semi-elasticity of saving with respect to the saving tax, u , and p is the propensity to consume in the first period out of second period income. It can be seen that $e_u^c = e_u + p > 0$ is the compensated semi-elasticity of saving with respect to the saving tax, u .

Noting (4), and (5), we can solve for the optimal savings and investment tax rates, u and v , as follows,

$$u = \frac{I}{e_u} \left[I - \frac{I}{\eta} \right] \quad (8)$$

$$v = \frac{e_u^c}{e_v e_u} \left[I - \frac{I}{\eta} \right] \quad (9)$$

where $\eta = \lambda / U_2$ is the marginal cost of public funds. Finally, from (6) and (7) we may derive the trade-off of public goods provision between periods 1 and 2 as $V'(G_1)/W'(G_2) = I + r$.

3. *Tax and debt policy in the closed economy*

In this section, we consider the optimal capital income tax policy in a closed economy. The closed economy is identical to any of the small open economies considered in the previous section. To distinguish the closed economy from the open economy, let the saving tax be denoted t , while the investment tax is x . The return to saving then is $I + r - t$, while the tax-inclusive cost of capital is $I + r + x$. In the closed economy, the saving-investment balance implies that $S = K + D$.

Profit maximization on the part of firms now yields a modified investment rule: $F'(K) = I + r + x$. The budget constraints on the part of consumers and the government are given by,

$$C_2 = (Y - C_1)(I + r - t) + F(K) - (I + r + x)K \quad (10)$$

$$G_2 = (X - G_1)(1 + r) + tS + xK \quad (11)$$

Again, the government chooses tax policy to maximize the utility of the representative agent. The government now maximizes the following Lagrangean expression,

$$L = U(C_t, (Y - C_t)(1 + r - t) + F(K) - (1 + r + x)K) + V(G_1) + W(G_2) + \lambda(xK + tS - (G_1 - X)(1 + r) - G_2) \quad (12)$$

The optimality conditions with respect to the tax instruments, t , x , and the spending levels, G_1 , G_2 , are as follows,

$$\begin{aligned} -U_2(1 - \delta \frac{dr}{dt}) + \lambda(1 - e_u t + \frac{dr}{dt}(-\delta + t(e_u + (1 - \delta)p) - (1 - \delta)e_v x)) &= 0 \\ -U_2(1 - \delta + \delta \frac{dr}{dx}) + \lambda(1 - \delta - (1 - \delta)e_v x + (1 - \delta)tp + \end{aligned} \quad (13)$$

$$\frac{dr}{dx}(-\delta + t(e_u + (1 - \delta)p) - (1 - \delta)e_v x) = 0 \quad (14)$$

$$\begin{aligned} V'(G_1) + U_2 \delta S \frac{dr}{dG_1} + \lambda(- (1 + r) + \frac{dr}{dG_1} S[-\delta + t(e_u + (1 - \delta)p) - \\ (1 - \delta)x e_v]) &= 0 \end{aligned} \quad (15)$$

$$W'(G_2) - \lambda = 0 \quad (16)$$

where $\delta = D/S$. Also, from the saving balance $S = D + K$, we find that,

$$\frac{dr}{dt} = \frac{e_u}{e_u + (1 - \delta)(e_v + p)}$$

$$\frac{dr}{dx} = - (1 - \delta) \frac{e_v + p}{e_u + (1 - \delta)(e_v + p)}$$

$$\frac{dr}{dG_1} = \frac{1}{S} \frac{1}{e_u + (1 - \delta)(e_v + p)}$$

Note that $\frac{dr}{dt} - \frac{dr}{dx} = 1$, which can be used to see that (13) and (14) are equivalent.

This reflects that both the saving and the investment tax affect the single tax wedge $z = t + x$ between the net return to saving and the gross return to investment. Essentially, there is only one capital income tax instrument in the closed economy, and it makes no difference whether investment or saving is subject to tax.⁶ After arbitrarily setting $t = 0$, we find from (13)-(16) the following optimal tax and spending rules,

$$x = \frac{e_u^c + e_v}{e_v e_u} \left[1 - \frac{1}{\eta} \right] \quad (17)$$

$$\frac{V'(G_1)}{W'(G_2)} = 1 + r + \frac{1}{e_u} \left[1 - \frac{1}{\eta} \right] \quad (18)$$

Note that $1 + r < \frac{V'(G_1)}{W'(G_2)} < 1 + r + x$, which indicates that the interest rate

that the government uses to trade-off public spending in the two periods lies between the net interest rate received by savers and the tax-inclusive cost of funds for investment.

4. *The scope for international tax and expenditure coordination.*

This section considers the scope for international coordination of capital income and debt policies. A global coordination of policy ultimately leads to the optimal tax and debt policies for the closed economy, as outlined in the previous section. In the present model, countries are only

linked through the international capital market. All countries are symmetric, and therefore there is no international indebtedness in equilibrium. As a result, national fiscal policy and the resulting interest changes do not have international pecuniary externalities. Changes in the interest rate, however, have an internal pecuniary externality in that a higher interest rate affects the trade-off between fiscal spending in the two periods. National governments do not take into account the implications of a change in the international interest rate on this public consumption trade-off abroad, which implies that public 'overborrowing' can result. Mitigating the tendency to 'overborrow' is the international tax competition for the mobile investment tax base financed by worldwide saving. This tax competition reduces tax rates and revenues, and thus the governments' tendency to borrow against these tax revenues. This section shows that the net effect of the borrowing and tax competition externalities depends on the availability of tax instruments and underlying model parameters.

At most, governments have four fiscal instruments at their disposal: government spending in either period, and the saving tax, u , and the investment tax, v (the latter two collapse into a single tax instrument in the closed economy case). In the open economy, the fiscal instruments, as available, are set so as to maximize national welfare, L , in (3). The partial effects of changes in these variables on national welfare are thus zero. Coordinated fiscal policy changes, however, still can affect welfare through their impact on the international interest rate that each country takes as given. Thus to assess various forms of fiscal coordination, we have to address two questions: (i) how does policy coordination affect the international interest rate, and (ii) how does a change in the international interest rate affect the national welfare.

To start with the second question, let us consider dL/dr . Applying (3), the international interest rate affects private welfare directly and through the public budget as follows,

$$\frac{dL}{dr} = S \left[\delta U_2 + \lambda [\delta + (1 - \delta) e_v v - (1 - \delta) u p - u e_u] \right] \quad (19)$$

In subsection 4.1, we first focus on the case where both saving and investment taxes are available to governments. In subsection 4.2, we subsequently consider the case where only source-based investment taxes are available.

4.1 *Both investment and saving taxes are available*

The case of both investment and saving taxes is considered by Bucovetsky and Wilson (1991) in the case where there are only second period public goods, or equivalently $V(G_I) = 0$. These authors show that there is no need to coordinate tax policy internationally, if both investment and saving taxes are available. In our more general setting, there is likewise no need for policy coordination, because with both capital income taxes present an international interest rate does not affect national welfare. To see why not, first remember that in the symmetric noncooperative equilibrium a change in the international interest rate has no pecuniary externality. Second, the small open economy optimal tax policy is characterized by a careful balancing of the marginal distortions to saving on the one hand and investment on the other. A marginal change in the interest rate leads to a slight increase in one of these distortions and a slight drop in the other. The combined welfare effect of these changes is zero. To show formally, that a change in the interest rate does not affect national welfare, we proceed as follows. We can add to (19) the first order condition for u from (4) and $1 - \delta$ times the first order condition for v from (5) to produce $dL/dr = 0$. We state this finding as,

Proposition 1. There is no scope to coordinate tax, spending and borrowing policies if governments have access to both investment and saving taxes and there is government spending in both periods.

4.2 *Only investment taxes are available*

Countries generally impose a residence-based tax on the capital income of their domestic

residents. As financial markets become internationally integrated, however, it becomes increasingly easy to evade the residence-based tax on the return to savings. A de facto diminution of the saving tax base implies that countries are left to tax capital income solely by way of source-based capital income taxes, as proxied by the investment tax in the present model. Reflecting the decline of the saving tax, this section considers the case where tax authorities only have access to an investment tax. After similarly excluding the saving tax from the tax instrument set, Bucovetsky and Wilson (1991) find that in the absence of policy coordination investment tax levels are too low.⁷ This section extends the earlier analysis for the case where there also is public spending in the first period. With a restricted tax instrument set, tax competition between countries and changes in international interest rates create externalities that are not properly weighed in the absence of coordination. Therefore, there generally is a need to coordinate international fiscal policies.

To establish this claim, we need to show that (i) with only investment taxes available, the derivative dL/dr is non-zero, and (ii) coordinated changes in fiscal policy affect the world interest rate. With only investment taxes present, the expression for dL/dr in (19) simplifies to

$$\frac{dL}{dr} = S \left[\delta U_2 + \lambda [\delta + (1 - \delta) e_v v] \right] \quad (20)$$

To this we can add δ times the first order condition for v from (5) to obtain,

$$\frac{dL}{dr} = -S \lambda e_v v \quad (21)$$

Thus an increase in the world interest rate affects national welfare levels negatively, with only investment taxes around. The reason is that a higher rate of interest discourages the taxed investment activity. It now follows that a coordinated (marginal) change in (at least two) fiscal policy instruments in all countries positively affects national welfares, if it brings about a reduction in the world interest rate. This suggests that indeed there is a scope for fiscal policy coordination.

To proceed to see how policies should be adjusted, note that in the world economy as a whole the interest rate r responds to the fiscal instruments v and G_I (given that the instrument u is not available) as follows,

$$dr = \frac{1}{N} \left[\frac{dG_I}{S} - (1 - \delta)(e_v + p) dv \right] \quad (22)$$

with $N = e_u + (1 - \delta)(e_v + p)$.⁸

Expression (22) reiterates that higher first period spending, G_I , occasions a higher interest rate, while a higher investment tax, v , leads to a lower interest rate. As before, any change in second period spending, G_2 , does not affect the interest rate.

Before stating our results, let us define two additional coefficients. Let $\hat{\epsilon}_v = - \frac{dK}{d(1 + r + v)} \frac{1 + r + v}{K}$ be the elasticity of investment with respect to the firm's tax-inclusive cost of funds. Also, let $\sigma = 1 - (1 + r)p$ be the marginal propensity to save in the first period out of first period income (remember that p is the marginal propensity to consume in the first period out of second period income so that $(1 + r)p$ is the marginal propensity to consume in the first period out of first period income)

We can now derive the following results,

Proposition 2. The noncooperative tax and expenditure equilibrium with only investment taxes will not be efficient from a world perspective. Thus there is a scope for international policy coordination. In particular, countries can gain by,

- (i) raising both v and G_2 (while leaving G_I constant) from the noncooperative equilibrium,
- (ii) raising G_2 and lowering G_I (while leaving v constant) from the noncooperative equilibrium,
- (iii) raising both v and G_I (while leaving G_2 constant) from the noncooperative

equilibrium if $\hat{\epsilon}_v > \sigma$ and vice versa.

The proof of parts (i) and (ii) is immediate from expression (22). The proof of part (iii) is relegated to the Appendix. According to parts (i) and (ii) of Proposition 2, public goods in period 2 will always be underprovided (in a marginal sense) in the non-cooperative equilibrium. As to public goods in period one, either underprovision or overprovision may occur. In particular, if $\hat{\epsilon}_v < \sigma$, so that investment is relatively inelastic and the propensity to save in the first period is high, then too many public goods are provided in the first period, and hence too high budget deficits will be recorded in that period.

To interpret these results, observe that an increase in G_I combined with an increase in v is welfare-improving if causes a drop in the interest rate, r . The higher G_I will have to be financed by a relatively large increase in v , if investment is rather elastic wrt. a change in the cost of capital, i.e. if $\hat{\epsilon}_v$ is large. A rise in v then leads to a relatively large drop in investment. A higher value of the investment tax, v , brings about a reduction of second period profits (income accruing to the fixed factor), causing a relatively large increase in first period saving, if the marginal propensity to save out of second period income, i.e. p , is rather high. A high value of p obviously implies a low marginal propensity to save out of first period income, σ . Hence, the increased first period spending and investment tax on net are welfare enhancing, if the investment elasticity is large relative to the first period saving propensity, and vice versa.

As an example, we can take the constant elasticity of substitution production function $f(K) = (\alpha_1 K^\rho + \alpha_2 L^\rho)^{\frac{1}{\rho}}$ with $\rho < 1$, where $1/(1 - \rho)$ is the constant elasticity of substitution and L is a fixed factor. The condition in part (iii) of the proposition is then found to be $\frac{1}{1 - \rho} \frac{1}{1 - \kappa} > \sigma$, where κ is the share of the (gross) return to all capital in total output. As a special case, the condition is satisfied for the Cobb-Douglas technology with ρ approaching 0. As the production function approaches the Leontief production function (with ρ approaching negative infinity for a given κ), the condition is not satisfied so that coordination leads to a lower

combination of ν and G_1 (keeping G_2 constant).

We wish to emphasize that Proposition 2 strictly concerns the effects of marginal policy changes from the noncooperative equilibrium. As such, it does not contain a direct comparison of policy settings in the noncooperative and cooperative equilibria. There is a strong presumption, though, that coordination will result in a higher provision of public goods in the second period that is likely to be financed by a higher investment tax. But whether full coordination will entail higher or lower public spending in the first period, and therefore a higher or a lower first period public deficit, cannot be inferred from the proposition.⁹

5. *A limitation on the size of budget deficits*

According to the Maastricht convergence criteria, budget deficits on the part of countries entering and participating in the European Monetary Union cannot exceed 3 percent of GDP. Similarly, the ratio of public debt to GDP cannot exceed 60 percent. In this section, we investigate the rationale for such international agreements on fiscal deficits and debts using the model of this paper. As already shown, with saving and investment taxes present, a limit on the size of first period deficit is immaterial if it is just marginally binding, but such a limit is directly harmful if it moves countries substantially away from their already efficient fiscal policies. With only investment taxes available, a forced reduction in first period deficits increases national welfares if and only if it serves to lower the world rate of interest. For this to be the case, investment should not be very sensitive to variations in the cost of capital, while the marginal propensity to save (in the first period) should be rather high. These latter issues become less important, however, the more the cut in first period spending is met with an increase in second period spending rather than lower investment taxes.

Next, we formally examine the desirability of limits on first period deficit spending. To start, we again note that a forced change in deficit spending, G_1 , and any induced change in the investment tax, ν , only can affect welfare through their effect on the international interest rate, r ,

if any. Noting the direct and indirect effects of a change in G_1 on the interest rate r , we obtain the following total derivative expression for dr/G_1 ,

$$\frac{dr}{dG_1} = \frac{\partial r}{\partial G_1} + \frac{\partial r}{\partial v} \frac{\partial v}{dG_1} \quad (23)$$

With any fiscal coordination, it remains the case that the world capital market clears and that public budget constraints are met. The implications of changes in the fiscal variables G_1 and v on the international interest rate, r , are apparent from (22), while the three fiscal policy variables, G_1 , G_2 , and v are restricted by the government budget constraint (2). Taking note of market and budget effects, we derive the following result

Proposition 3. A (binding) limitation of countries' first period budget deficits will be welfare-improving if and only if $\sigma - \hat{\epsilon}_v - (e_v + p) \frac{dG_2}{dG_1} > 0$ (24)

For a proof, see the Appendix. An increase in G_1 can be followed by a change in either v or in G_2 . Thus Proposition 3 is a weighted combination of parts (ii) and (iii) of Proposition 2. With $\sigma - \hat{\epsilon}_v > 0$, a reduction in both G_1 and v is welfare-improving by part (iii) of Proposition 2. A reduction in G_1 is also welfare-improving if it increases G_2 , i.e. if $dG_2/dG_1 < 0$ by part (ii) of Proposition 2. An elaborate and tedious calculation (see the Appendix) shows that dG_2/dG_1 in all but the most exceptional circumstances will be negative. In the end, of course, whether the condition in Proposition 3 calls for a coordinated limitation in deficit spending to be welfare-improving holds is an empirical matter.

In a technical appendix to this paper (available from the authors), we construct and calibrate a simulation model corresponding to the theoretical model of this paper. For a set of realistic specifications of preferences and the production structure, we show that a coordinated reduction in deficit spending lowers welfare. In fact, we have to resort to assuming a rather

inflexible production structure and a rather low rate of pure time preference to render a coordinated first period deficit reduction welfare improving. Our research thus does not provide support for international ceilings on deficit spending on efficiency grounds.

6. *Conclusion*

This paper has investigated the scope for fiscal coordination in a model where public expenditures in each of two periods are financed by capital income taxes. The focus has been on whether there is a need for fiscal coordination on efficiency grounds. The paper thus abstracts from the possibility of an international redistribution (say, through a common central bank) and from any internal political pressures to engage in deficit spending. The case for international fiscal coordination depends importantly on the set of tax instruments available in all of the countries. With both investment and saving taxes available, we find that there is no need to coordinate either tax or spending policies.

In the absence of a saving tax instrument, however, fiscal policies generally should be coordinated. In fact, any coordinated policy change that occasions a lower world interest rate is welfare improving. A lower interest rate is shown to result from a higher investment tax or lower first period government spending. Lower first period government spending followed by higher second period government spending, therefore, is welfare improving. Lower first period government spending followed by a lower investment taxes, in contrast, has an ambiguous effect on the world interest rate, and thus also on national welfares.

A coordinated limitation on first period deficits leaves countries to choose their subsequent investment taxation and second period government spending in a non-cooperative fashion. In this instance, a coordinated deficit limitation is welfare improving, if most of the second period fiscal adjustment is in government spending. Only in a knife-edge case will the investment tax and second period government spending be adjusted so as to leave the international interest rate and also welfare unchanged. In any other case, the coordination of deficit spending

potentially improves welfare, and thus the question in the paper's title is answered affirmatively. Simulations with the model suggest that deficit spending limitations reduce welfare levels for reasonable calibration assumptions. Our research thus does not provide support for the Maastricht deficit spending limitations on efficiency grounds.

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Appendix

In this appendix, we first prove part (iii) of Proposition 2. We do this in such a way that the proof of Proposition 3 easily follows. In particular, we consider the general case where changes in G_I are met by changes in both v and G_2 , even though part (iii) of Proposition 2 only relates to changes in G_I and v .

At all times, the government budget constraint requires that government net revenues, $R = vK - (G_I - X)(1 + r) - G_2$, remain equal to zero, i.e.

$$\frac{dR}{S} = (1 - \delta)(1 - e_v v)dv - (\delta + (1 - \delta)e_v v)dr - (1 + r) \frac{dG_I}{S} - \frac{dG_2}{S} = 0$$

After substitution for dr from (22), we find how the change in the investment tax, dv , is related to the changes in the two spending variables, dG_I and dG_2 , as follows,

$$dv = \frac{[1 + r + \frac{\delta + (1 - \delta)e_v v}{N}] \frac{dG_I}{S} + \frac{dG_2}{S}}{(1 - \delta)[1 - e_v v + \frac{\delta + (1 - \delta)e_v v}{N}(e_v + p)]}$$

Inserting this back into (22) yields us the following expression for the interest rate change,

$$\frac{dr}{dG_I} = \frac{\sigma - \hat{\epsilon}_v - (e_v + p) \frac{dG_2}{dG_I}}{S[(1 - e_v v)N + (\delta + (1 - \delta)e_v v)(e_v + p)]}$$

Now it is seen that an increase in G_I , financed by an increase in v (holding G_2 constant) will be welfare improving if $\hat{\epsilon}_v > \sigma$. This proves part (iii) of Proposition 2. The above expression similarly gives the proof of Proposition 3 for the case where governments can optimally

adjust G_2 in response to a change in G_1 .

The above three equations can be used to solve for $d G_2 / d G_1$ as follows

$$\frac{d G_2}{d G_1} = \frac{A}{B}$$

with

$$A = \frac{\sigma - \hat{\epsilon}_v}{[(1 - e_v v)N + (\delta + (1 - \delta)e_v v)(e_v + p)]} *$$

$$\left[\frac{U_{22}(1+r) - U_{21}}{1 - e_v v} (e_u + (1 - \delta)p) + \frac{U_{22}}{1 - e_v v} \delta + \frac{U_2/S}{(1 - e_v v)^2} v(e_v)^2 \left(\frac{F'''K}{F''} + 1 \right) \right] +$$

$$\left[\frac{(1+r) + \frac{\delta + (1 - \delta)e_v v}{N}}{(1 - \delta)(1 - e_v v + \frac{\delta + (1 - \delta)e_v v}{N}(e_v + p))} \right] *$$

$$\left[\frac{U_{22}(1+r) - U_{21}}{1 - e_v v} (1 - \delta)p - \frac{U_{22}}{1 - e_v v} (1 - \delta) + \frac{U_2/S}{(1 - e_v v)^2} e_v \left(1 + e_v v \left(\frac{F'''K}{F''} + 1 \right) \right) \right]$$

$$B = W''(G_2) + \frac{e_v + p}{(1 - e_v v)N + (\delta + (1 - \delta)e_v v)(e_v + p)} *$$

$$\left[\frac{U_{22}(1+r) - U_{21}}{1 - e_v v} (e_u + (1 - \delta)p) + \frac{U_{22}}{1 - e_v v} \delta + \frac{U_2/S}{(1 - e_v v)^2} v e_v^2 \left(\frac{F'''K}{F''} + 1 \right) \right] -$$

$$\frac{l}{(1-\delta) \left(1 - e_v v + \frac{\delta + (1-\delta) e_v v}{N} (e_v + p) \right)}^*$$

$$\left[\frac{U_{22}(1+r) - U_{21}}{1 - e_v v} (1-\delta)p - \frac{U_{22}}{1 - e_v v} (1-\delta) + \frac{U_2/S}{(1 - e_v v)^2} e_v \left(1 + e_v v \left(\frac{F'''K}{F''} + 1 \right) \right) \right]$$

Notice that $U_{21} = 0$ and $\frac{F'''K}{F''} + 1 < 0$ and $1 + e_v v \left(\frac{F'''K}{F''} + 1 \right) > 0$ are sufficient conditions to obtain $dG_2/dG_1 < 0$.

Endnotes

1. For a survey, see Blanchard and Summers (1984).
2. Huizinga and Nielsen show that this result no longer holds if there is some international ownership of firms, unless there is full taxation of economic profits. See Keen (1993), Ruding (1992), and Sørensen (1993) for analyses of the scope for capital and other tax coordination within Europe.
3. Plus some additional political economy models.
4. With a small number of countries, each country takes into account the effect on its policy on the international interest rate. As long as there are 2 or more countries, however, the qualitative reasons for policy coordination outlined in this paper remain.
5. Lump sum taxes are not available. If they were, there would be no scope for policy coordination. X may stand for revenue from predetermined taxes in the first period. Similarly, Y may be disposable income after such predetermined taxes have been levied in period 1.
6. One might argue that if public debt is non-zero, the bases of the saving and investment taxes would be different. However, with no consequences at all, a withholding tax at the same rate as the investment tax could be levied on the stock of public debt to make the combined investment-withholding tax base equal to the saving tax base. The reason why such an additional withholding tax would be immaterial is that the extra tax revenue would be fully offset by an increase in the cost of capital for the government (which would rise to $r + x$).
7. In addition to the investment tax, Bucovetsky and Wilson (1991) consider a wage tax. For small open economies without any capital market power, only the wage tax is used resulting in a suboptimally low provision of public goods.
8. Expression (22) follows from the derivative expressions following eq. (16).
9. Indeed, simulations with a simple version of the theoretical model in this paper consistently show that moving from the non-cooperative equilibrium to full coordination involves raising both G_2 and v , whereas G_1 may either rise or fall.